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THE

BAKER-PILLIOD VALVE GEAR

SUPPLEMENT TO

The Science of Railways

By
MARSHALL M. KIRKMAN

CHICAGO
CROPLEY PHILLIPS COMPANY
1912

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THE

BAKER-PILLIOD VALVE GEAR

SUPPLEMENT TO

The Science of Railways

By
MARSHALL M. KIRKMAN

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1912

velocity toward the ends of its stroke. The same irregular linear movement is made by the eccentric rod, and it will be noticed that the crosshead is near the center of its stroke, the swiftest part of its motion, while the eccentric crank which is set at right angles to the main crank is experiencing its slowest movement. The union link attached to the crosshead and the eccentric rod are attached to the separate ends of a bell crank. The end of the bell crank attached to the eccentric rod describes a circle or ellipse, according to the relative proportions of the arms of the bell crank, but always at irregular velocity. This varying motion is conveyed by a coupling and hanger to another bell crank, the lower end of which is attached to the valve rod, which in turn is attached to the valve rod crosshead to which the valve stem is attached and held in place by adjustable nuts. The result of the two initial motions conveyed through this double system of bell cranks is such that the valve travels as fast as the piston at the beginning of its stroke and by the time the piston has moved about one-twentieth of its stroke the valve is wide open and the valve then moves very slowly during the period while the piston is traveling with increasing rapidity during the first half of its stroke. As the piston approaches the release point the valve again travels with increasing rapidity and closes with a speed equal to that of the piston.

Baker-Pilliod Valve Gear

The combination known as the "Baker-Pilliod" valve gear resembles the Walschaerts gearing in the following respects: It has the eccentric crank attached to the main crank pin and a combination lever deriving its motion from the crosshead.

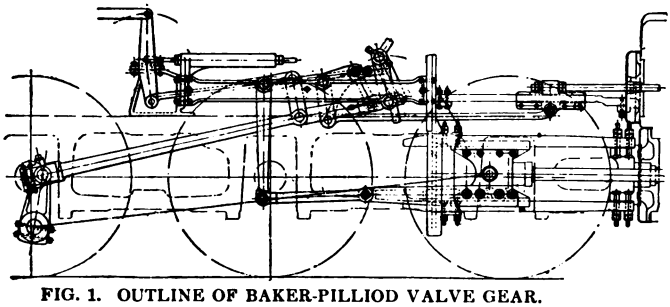

FIG. 1. OUTLINE OF BAKER-PILLIOD VALVE GEAR.

Figure 1 shows an outline of the Baker-Pilliod valve gear. It will be noticed that there are a number of rods, levers and bell cranks and brackets which in appearance form a complex combination, but which when followed one by one lead from the circular movement of the eccentric crank and the reciprocating movement of the crosshead to the simple reciprocating motion imparted to the valve rod. Neither of these primary movements are regular in their linear velocity; the crosshead travels with an increasing degree of rapidity toward the center and diminishes in

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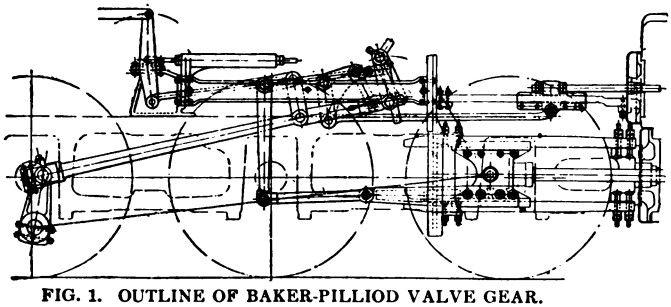

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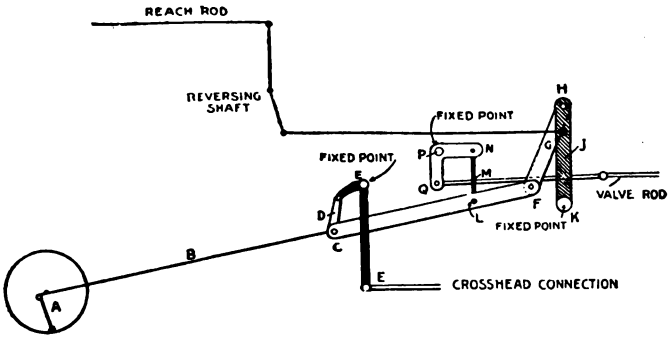

FIG. 2. DISTORTED SKELETON SKETCH OF BAKER-PILLIOD GEAR.

The reversing gear is shown in Fig. 2, which represents a skeleton sketch of the valve gear, shaded and purposely distorted to show more clearly the movable and fixed parts of the gearing. It will be observed that the continuance of the eccentric arm after passing the two bell cranks already described is attached to a hanger G, at the point F. This hanger is suspended from the upper end of a radius yoke J, which is attached to a fixed point at K. The point F therefore swings about the point H. This radius yoke J is suitably attached to the gear reach rod which is connected to the reversing shaft. Assuming that the piston and slide valve and reverse lever are all in the central position, it can be seen that in the event of the reach rod being moved to the front end of the quadrant, the lower arm of the reversing shaft will be drawn backward, carrying with it the radius yoke, which hangs from the top of the reverse yoke. This backward movement of

rigidity of construction which is impossible in the case of the Stephenson shifting link gear and is only partially so in the case of the Walschaerts gearing.

The lead or opening of the valve at the end of the piston stroke is an unvarying or constant quantity, so that the length of the valve stroke or point of cut-off of steam supply does not in any way affect the exact amount of opening at the beginning of each piston stroke, while the degree of rapidity with which the valve opens during the early part of the piston stroke or the rapidity with which the valve closes at the desired point of cut-off is not surpassed by any kind of valve gearing applied to locomotives.

One of the advantages claimed for the Baker-Pilliod gearing is that, when properly constructed and adjusted to the locomotive, the valve gearing passes outside of the pale of the constant consideration of the engineer or mechanic, and while liable, of course, to a certain amount of wear and possible fracture, it is not subject to those erratic variations peculiar to some forms of valve gearing. Generally speaking, the eccentric rod is the only part that may occasion a renewal of adjustment, as the wear of the bearings at the main crank or in the main driving boxes may occasion a slight variation in point of length of the eccentric rod. The gear reach rod and eccentric arm as well as the valve rod are all fitted with means for adjustment in regard to length, so that the equalization of the travel of the valve can be

readily effected in the original assembling of the parts.

The amount of lead or opening of the valve at the beginning of the piston stroke can be increased or diminished by lengthening or shortening the lower arm of the bell crank. By lengthening the arm of the bell crank attached to the valve rod connection an increase in the length of the valve stroke is made, and this increase will be added to the amount of valve opening at the end of the piston stroke. A corresponding decrease will occur in the case of shortening the bell crank arm. These changes, however, are rarely necessary.

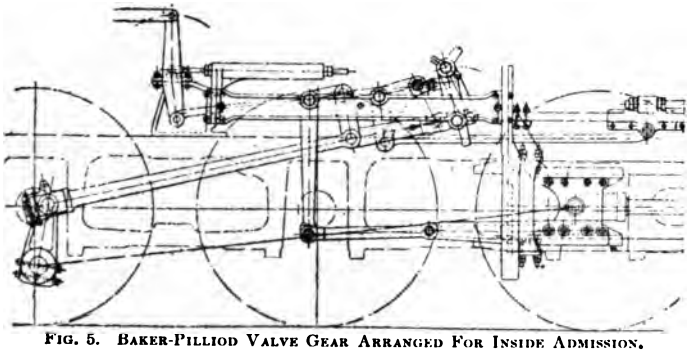

FIG. 5. BAKER-PILLIOD VALVE GEAR ARRANGED FOR INSIDE ADMISSION.

The exact position of the eccentric crank in relation to the main crank is a variable point to the designer, and is adapted by him to suit the requirements of the valve gear construction. In the case of an inside admission valve, the return or eccentric crank follows the main crank when the

engine is running forward. In the case of an outside admission valve, the eccentric crank is set a corresponding distance ahead of the main crank. The length of the eccentric crank is also a variable quantity to the designer. The eccentric crank used in the case of an inside admission valve is longer than that used in the case of an engine equipped with a valve having outside admission. The necessity for this variation is apparent when it is observed that the angle of inclination of the eccentric rod is an ascending one towards the lifter bar and bell crank. These necessary variations will be readily observed in comparing the illustration of the different positions of the eccentric crank, as shown in Fig. 5, which displays the arrangement of the eccentric crank and lifter bar adapted to an inside admission valve, with that of Fig. 6, which shows the parts arranged from an outside admission valve.

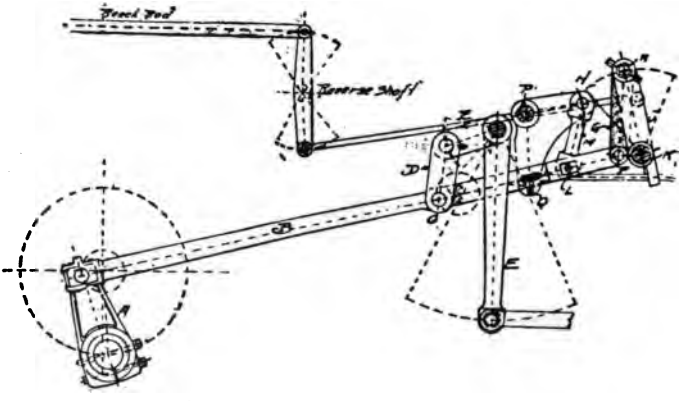

FIG. 6. BAKER-PILLIOD VALVE GEAR ARRANGED FOR OUTSIDE ADMISSION.